MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2015/2016

BFC2064 – FORECASTING

(All sections / Groups)

9 MARCH 2016
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **TWO (2)** sections in **NINE (9)** printed pages:
   Section A: Twenty (20) Multiple Choice Questions
   Section B: Three (3) Structured Questions

2. Answer **ALL** questions in the answer booklet provided.

3. Show all calculation workings in the answer booklet.

4. Marks are shown at the end of each question.

SECTION A: TWENTY (20) MULTIPLE CHOICE QUESTIONS (40 marks)

1. Forecast is:
   a. an estimate of a forecast outcome expected at a future time period.
   b. a prediction of an actual outcome expected at current time period.
   c. an estimate of an actual outcome expected at a future time period.
   d. a prediction of a forecast outcome expected at current time period.

2. The purpose of forecasting is:
   a. to aid decision making.
   b. to decide on the forecast horizon.
   c. to identify the value of forecast.
   d. to evaluate the effectiveness of forecast.

3. The following is an example of forecasting problem EXCEPT:
   a. Observations are not equally spaced in time.
   b. Seasonal effects.
   c. Unusual observations.
   d. Incorrect assumptions.

4. Which of the following methods should be used if one obtains sufficient quantitative data but explanatory variables are not available?
   a. Judgmental method.
   b. Exponential smoothing method.
   c. Simple linear regression.
   d. Vector Autoregression.

5. The following is the basic consideration to successful forecasting EXCEPT:
   a. Purpose.
   b. Parsimony principle.
   c. Loss function.
   d. Forecast horizon.

6. Which of the following forecast provides the most information?
   a. Point forecast.
   b. Interval forecast.
   c. Density forecast.
   d. Probability forecast.

7. What is optimal forecast?
   a. Expected loss is minimized.
   b. Expected loss is maximized.
   c. Expected loss is optimized.
   d. Expected loss is at steady state.

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8. The following is the reason why parsimony principle is considered EXCEPT:
   a. Anomalous behavior is more easily spotted.
   b. Simpler models are more easily interpreted.
   c. Lessen the scope of data collection.
   d. Restrictions are easily imposed.

9. Which of the following is a forecast object?
   a. Point forecast.
   b. Event outcome forecast.
   c. Interval forecast.
   d. Probability forecast.

10. The following error measurements can be used to compare across series EXCEPT:
   a. Root Mean Square Error.
   b. Mean Absolute Scaled Error.
   c. Theil's Coefficient.
   d. Mean Absolute Percentage Error.

11. Given the forecast error measures in Table 1.

Table 1

Forecasting methods	Error Measures		
	MAPE	RMSE	Theil's U
Method I	19.1	211	0.66
Method II	51.5	440	1.38
Method III	28.8	433	1.36
Method IV	25.8	318	1.00

Which of the forecasting method produces the most accurate forecasts?
   a. Method I
   b. Method II
   c. Method III
   d. Method IV

12. Given the point forecast is 62.2 and mean square error is 25. The 95% prediction interval is
   a. [13.2, 111.2]
   b. [52.4, 72.3]
   c. [53.975, 70.425]
   d. [21.075, 103.325]

13. Which of the following is a purely additive model for a seasonal series?
   a. $Y = TS + E$
   b. $Y = T + S + E$
   c. $Y = TSE$
   d. $Y = T + E$

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14. Refer to the following methods:
    i. The Holt-Winters Seasonal Smoothing Method
    ii. Autoregressive Integrated Moving Average
    iii. Linear Exponential Smoothing Method

    To forecast a value, these methods use
    a. One series.
    b. Two series.
    c. Three series.
    d. Four series.

15. Consider ARIMA model (2, 2, 2), $d = 2$ represents:
    a. second-order autoregression.
    b. integrated of order of two.
    c. second-order moving average.
    d. second-order autoregression moving average.

16. A time series is stationary if:
    a. it has a changing mean and variance and its autocorrelations depend only on the relative time between the observations.
    b. it has a constant mean and variance and its partial autocorrelations depend only on the relative time between the observations.
    c. it has a constant mean and variance and its autocorrelations depend only on the relative time between the observations.
    d. it has a changing mean and variance and its partial autocorrelations depend only on the relative time between the observations.

17. If the residuals of an ARIMA model do not pass diagnostic checking, one should proceed to:
    a. Re-identify the values of p, d and q.
    b. Re-estimate the ARIMA model.
    c. Re-do the diagnostic tests.
    d. Forecasting series.

18. Which of the following models is best for forecasting a highly volatile series?
    a. Autoregressive Integrated Moving Average.
    b. Autoregressive Conditional Heteroscedasticity.
    c. Generalized Autoregressive Conditional Heteroscedasticity.
    d. Structural Vector Autoregression.

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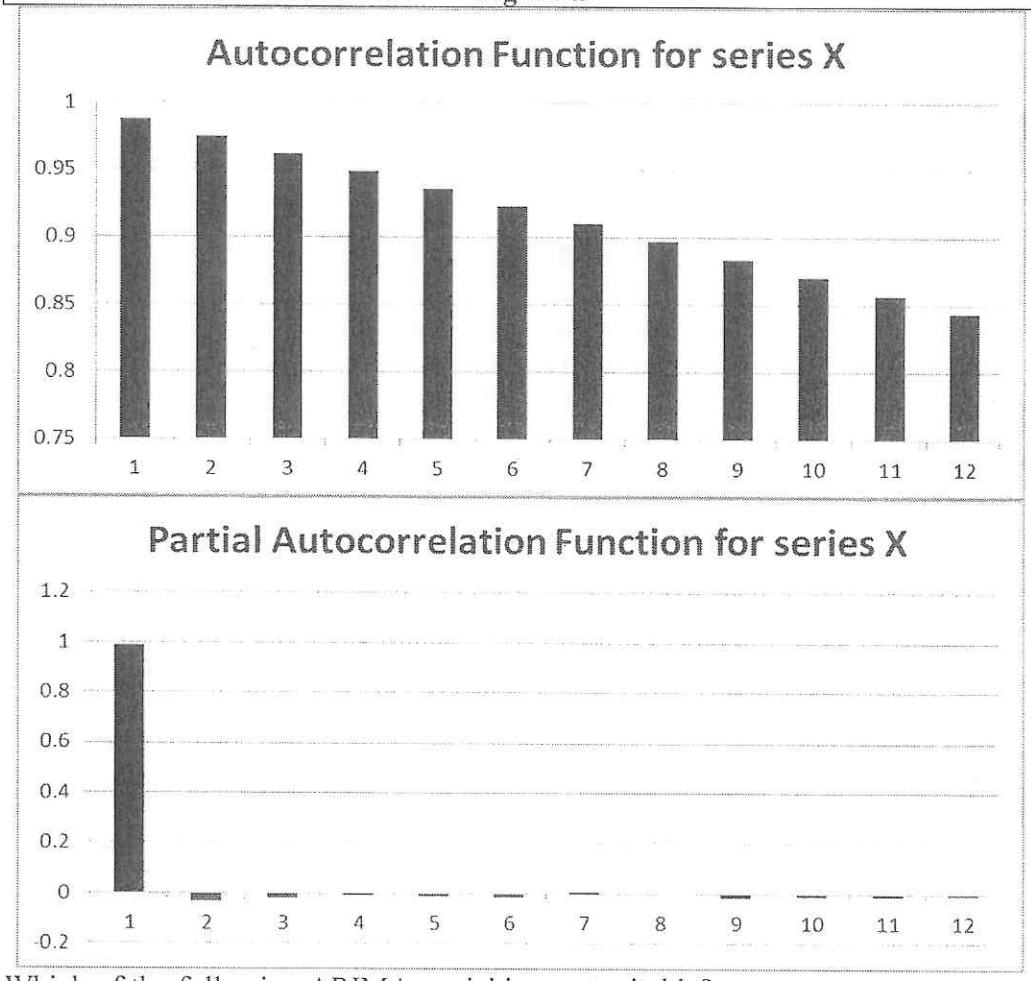
19. Suppose series X is integrated of order of one and has the following autocorrelation and partial autocorrelation functions in Figure 1.

Figure 1



Which of the following ARIMA model is most suitable?

a. ARIMA (1, 1, 0)
b. ARIMA (1, 0, 1)
c. ARIMA (1, 1, 1)
d. ARIMA (0, 1, 1)

20. The method of Ordinary Least Squares determines:

a. the constant and slope of a regression line by optimizing the sum of squared errors.
b. the constant and slope of a regression line by minimizing the sum of squared errors.
c. the constant and slope of a regression line by maximizing the sum of squared errors.
d. the constant and slope of a regression line when the sum of squared errors are at steady state.

SECTION B: THREE (3) STRUCTURED QUESTIONS (60 marks)

Question 1

The following is the actual gross domestic product (Y) from 2006Q1 to 2008Q4:

Time	Gross domestic product (RM billion)
2006Q1	112.17
2006Q2	112.92
2006Q3	113.14
2006Q4	113.56
2007Q1	113.58
2007Q2	114.91
2007Q3	116.26
2007Q4	116.21
2008Q1	116.46
2008Q2	117.27
2008Q3	117.12
2008Q4	115.99

(a) Generate the forecast values for 2008Q1 to 2008Q4 using:

(i) Simple exponential smoothing with $\alpha = 0.5$. (4 marks)

(ii) Purely seasonal exponential smoothing with $\gamma = 0.5$. (6 marks)
Note: The actual values in 2006 are used as forecast values for 2007.

(iii) ARIMA (1, 1, 0) with the equation: $Y_{t+1} = 0.045 + 1.666Y_t - 0.666Y_{t-1}$. (8 marks)

(b) Compute MAE, RMSE and Theil's coefficient for each forecasting method in part (a). (9 marks)

(c) Based on part (b), recommend a best forecasting method to predict gross domestic product. Explain. (3 marks)

[Total marks: 30 marks]

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Question 2

A multiple regression model is developed to forecast the rate of annual homicides in the United States. The model is specified as follows:

$$HOM_t = \alpha + \beta_1 GDP_t + \beta_2 DROP_t + \beta_3 REC_t + \varepsilon_t$$

HOM : the rate of homicides per 1000,000 of the population
GDP : real gross domestic product per capita (USD)
DROP : the high school dropout rate (%)
REC : value of 1 if recession is present and value of 0 if recession is absent
ε : error term

The following is the estimation output for the multiple regression above.

Dependent variable: HOM
Sample period: 1972 2001
Observation: 30

Variables	Coefficient	*t*-statistic	*p*-value
Constant	17.3377	7.4230	0.0000
GDP	-0.0002	-5.4714	0.0000
DROP	-0.4531	-1.8002	0.0834
REC	0.4597	1.3177	0.1991
$R^2 = 0.6345$			
F-statistic = 15.0453 (*p*-value = 0.0000)			

Based on the information above, answer the following questions:

(a) Perform *t*-test for each independent variable and discuss their significance in explaining the rate of annual homicides at 10% significance level. (9 marks)

(b) Interpret the value of the coefficient of REC. (2 marks)

(c) Given that GDP = 39165, DROP = 5 and REC = 1 in 2001, forecast the rate of annual homicides in 2002. (3 marks)

(d) Based on the forecasted HOM in part (c), create a 95% prediction interval for 2002. Assume that the estimated standard error is 0.9739. (4 marks)

(e) If the actual rate of annual homicides in year 2002 is 5.65. Is your forecast accurate? Explain. (2 marks)

[Total marks: 20 marks]

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Question 3

House Prices Still Surging in Malaysia

House prices in Malaysia continue to surge, despite anti-speculation measures. In Q3 2013, Malaysia's national house price index rose by 10.1% (7.8% in real terms) year-on-year. This year's price rise, nationally, was only slightly lower than last year's, which was 11.9% (10.4% in real terms).

Kuala Lumpur's house price index rose especially dramatically, with nominal prices up by 14.4% (11.9% in real terms). Kuala Lumpur has the most expensive houses in the country, with an average house price of MYR 620,758 (US$ 189,342). It is followed by Sabah and by Selangor, with average prices of MYR 413,187 (US$ 126,030) and MYR 405,826 (US$ 123,784), according to the Valuation and Property Services Department (JPPH).

House prices also surged in Johor (20.4%), Pulau Pinang (14.3%), and Negeri Sembilan (6.3%). Selangor and Perak had the lowest annual price growth at 4.3% and 3.7%, respectively.

Recent anti-speculation measures are expected to lessen transactions volumes. But property prices in upcoming areas/hotspots are expected to continue rising, according to Knight Frank. Partly because the market overhang has diminished - the number of housing units launched in Q3 2013 fell to 3,736 units, 74.5% lower than the 14,662 units launched during the same period last year. The number of houses sold, relative to stock, was 18.7% in Q3 2013, up from 15.3% in Q2 2013, and 12.5% from the previous year.

This article is adopted from www.globalpropertyguide.com/Asia/Malaysia dated Mar 5, 2014.

(a) Based on the context of the above article, discuss the following basic considerations to successful forecasting:

(i) Decision environment (2 marks)

(ii) Forecast object (2 marks)

(iii) Forecast statement (2 marks)

(iv) Forecast horizon (2 marks)

(v) Information set (2 marks)

[Total marks: 10 marks]

End of Questions

Formula sheet

Mean Absolute Deviation (MAD) $= \dfrac{\sum |d_i|}{n}$

Variance (S^2) $= \dfrac{\sum d_i^2}{(n-1)}$

Standard Deviation (S) $= \sqrt{S^2}$

Mean Absolute Error (MAE) $= \dfrac{1}{n}\sum_{i=1}^{n} |Y_{t+i} - F_{t+i}|$

Mean Square Error (MSE) $= \dfrac{1}{n}\sum_{i=1}^{n} (Y_{t+i} - F_{t+i})^2$

Root Mean Square Error (RMSE) $= \sqrt{MSE}$

Theil's U (U) $= \dfrac{\left\{\sum_{i=1}^{n} [Y_{t+i} - F_{t+i}]^2\right\}^{\frac{1}{2}}}{\left\{\sum_{i=1}^{n} [Y_{t+i} - Y_{t+i-1}]^2\right\}^{\frac{1}{2}}}$

Simple exponential smoothing (SES)
$F_{t+1} = F_t + \alpha(Y_t - F_t)$
Starting value: $F_{t+1} = Y_t$

Purely seasonal exponential smoothing
$F_{t+m}(m) = F_t(m) + \gamma[Y_t - F_t(m)]$

Prediction interval
(a) For single series: $F_{t+1} \pm t_{\frac{\alpha}{2}}(SE)$
(b) For multiple series: $F_{t+1} \pm t_{\frac{\alpha}{2}}(n-K-1) * SE(Y_{t+1} - F_{t+1})$

Statistical Tables

Appendix 1: *t*-Table

two tails	0.2	0.1	0.05	0.02	0.01
One tail	0.1	0.05	0.025	0.01	0.005
df					
10	1.37	1.81	2.23	2.76	3.17
20	1.33	1.72	2.09	2.53	2.84
30	1.31	1.70	2.04	2.46	2.75
40	1.30	1.68	2.02	2.42	2.70
50	1.30	1.68	2.01	2.40	2.68
60	1.30	1.67	2.00	2.39	2.66
75	1.29	1.67	1.99	2.38	2.64
100	1.29	1.66	1.98	2.36	2.63
120	1.29	1.66	1.98	2.36	2.62
∞	1.28	1.65	1.96	2.33	2.58

End of Paper